# VetMed: Improvement in Workflow of Canine Tooth Adjustment

Parker Callender, Ethan Frohna, Sanam Jhaveri, Justin Grudem, Sammie Gilarde, Amy Cao
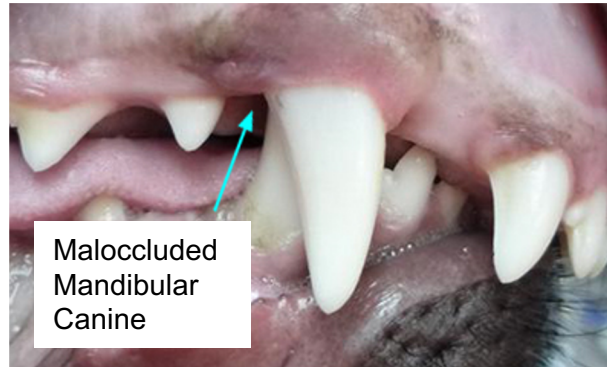
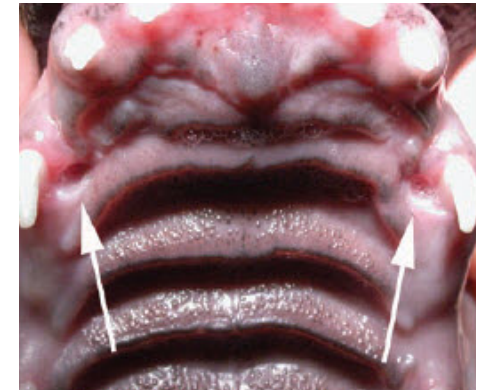# Class II Malocclusion in Dogs

- Misalignment of the mandibular (lower) and maxillary (upper) jaw
  - Results in oral pain and/or disease
- <u>Three</u> important teeth

  → Maxillary (Upper) Incisor #3, Maxillary (Upper) Canine, Mandibular (Lower) Canine
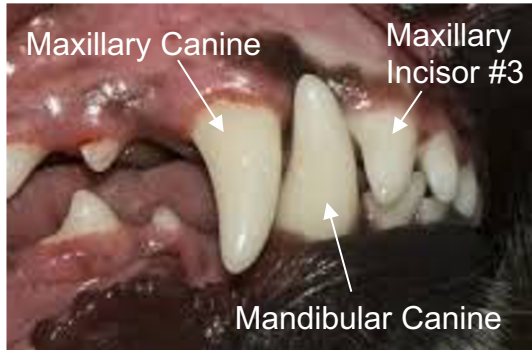
Normal arrangement of teeth

Class 2 Malocclusion

Damage caused by maloccluded canines (inflammation)

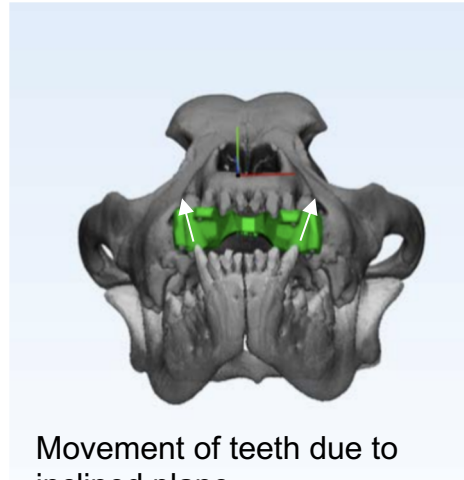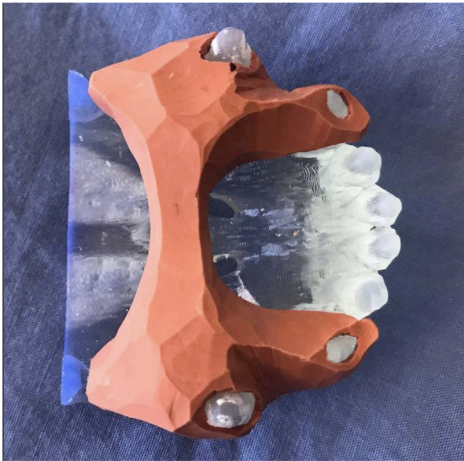# Current Treatments for Class II Malocclusion

Include:

- Extracting teeth
- Shortening teeth
- Orthodontics

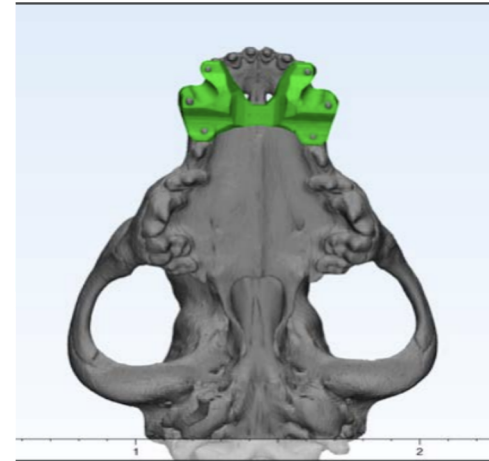 → Adjusting Ramp

Upper Jaw

Lower Canines

"DOG BRACES"

"Dog Braces" Acts as Ramp to Adjust Tooth's Angle

- Dr. Graham Thatcher's Solution: Incline Plane ("Dog Braces")
  - Acts as **ramp** to push lower canines out into correct position
 - Attaches to upper jaw

Movement of teeth due to inclined plane

The Goal of Our Software Solution

What if your iPhone didn't have the "red-eye fixer" button to fix your fantastic sunset photos? What would you do...?

1. Send your photo to photographic engineer
2. Wait for them to fix your red-eye
3. Wait some more
4. Receive the "fixed" photo
5. Realize it isn't to your liking
6. **Send it back**
7. Wait
8. Repeat
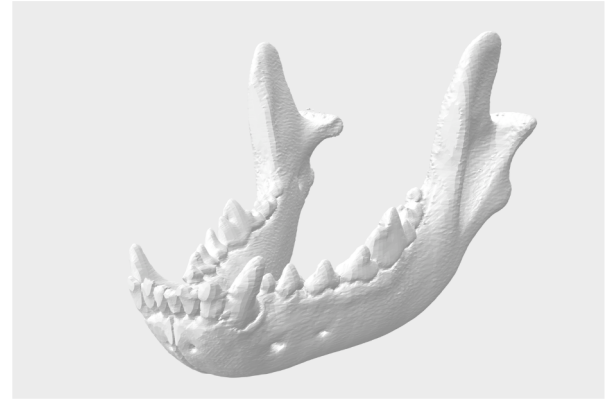
THIS is the current problematic process for Dr. Thatcher to design the DOG BRACES (Incline Plane)

Project Problems and Client's Requests

- Current software is inefficient
  - Software engineer needed
  - Time consuming
- Current incline plane (Dog Braces) model is not versatile
  - Only fitted to individual dogs
- Creation process is chaotic
  - Requires anesthesia to put on, take off, <u>and make adjustments</u>

Key Points of Our Product Design Specification

Device ("Dog Braces")

- 3-8 weeks 24/7 in patient's mouth

- Adjust canines: ~30° angle (will vary based on dog anatomy)
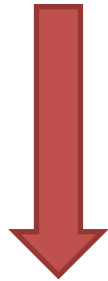
- Withstand 400 lbs of force from dog's bite.

Software

- Easily utilized by veterinary orthodontist

- Compatible with common computers

- Ability to convert a DICOM file to an stl file

- Manipulate cross sections of DICOM file to move desired teeth to right position

Two Project Pathways

Device Design

Software Design

Improve the effectiveness, adaptability, and durability of the "Dog Braces" itself.
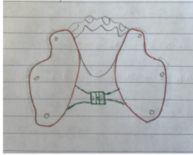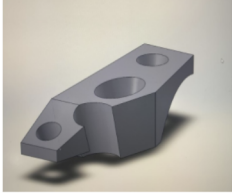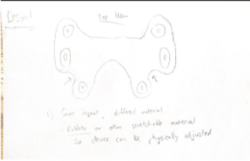
Develop a software pathway to improve Dr. Thatcher's process of designing the "Dog Braces".
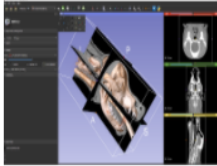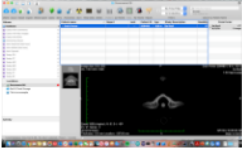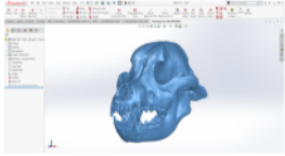
Design Matrix: Alternative "Dog Braces"

Design Criteria	Design One: Adjustable Bridge	Design Two: Separate	Design Three: Rubber Inclined Plane
Effectiveness (30)	25	20	25
Adaptability (20)	15	20	15
Ease of Manufacturing (15)	5	15	10
Durability (15)	10	15	5
Safety (10)	5	5	10
Cost (10)	10	10	10
Total(100)	70	85	75

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Design Matrix: Software

Design Criteria	Design One: 3D Slicer	Design Two: Osirix	Design Three: Geomagic
Effectiveness (30)	15	20	25
Adaptability (20)	0	10	18
Ease of Use (15)	15	10	10
Safety (10)	5	5	10
Cost (10)	0	0	5
Total(85)	35	45	58

*Effectiveness:
1. 3D imagine
2. Alter dimensions
3. Convert to stl

Learning the Software and Moving Forward

Stl and DICOM → Edit and Isolate → Match and Bridge → 3D Print → Design Changes

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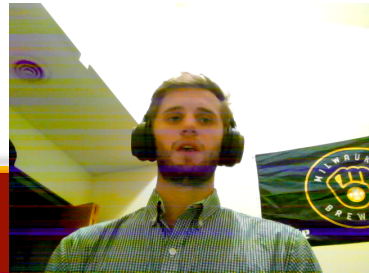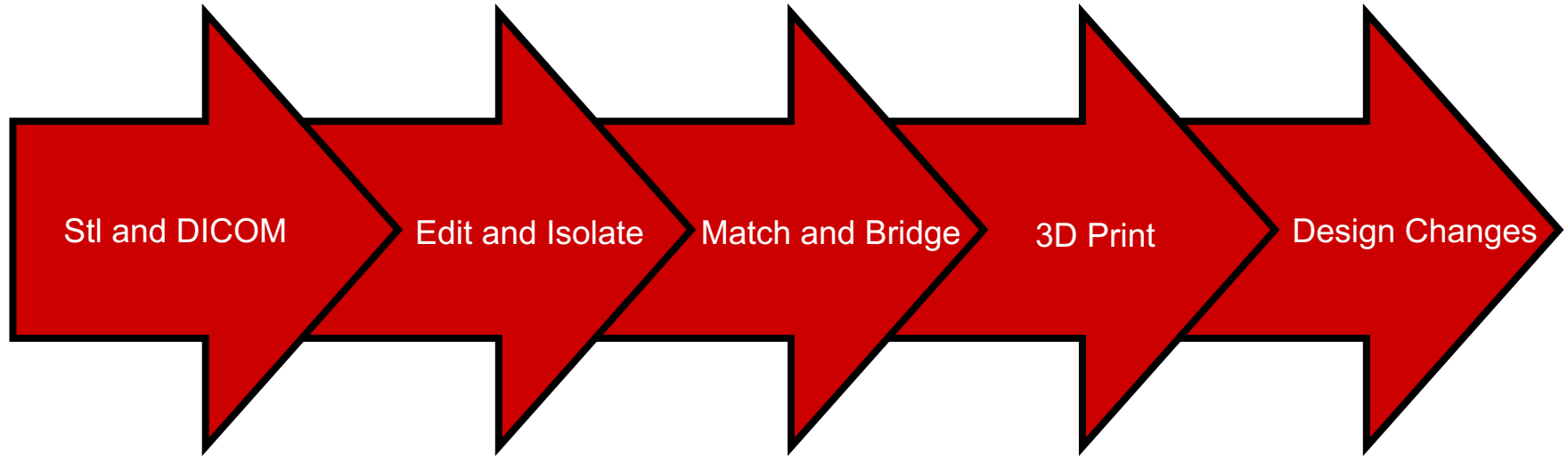
Acknowledgements

We would like to thank our client, Dr. Thatcher, and our advisor, Dr. Walter Block

References

- Thatcher, Graham. "Diagnosis and management of Class II malocclusion." *The Canadian veterinary journal = La revue veterinaire canadienne* vol. 60,7 (2019): 791-795.

- Osirix Tutorial: https://www.youtube.com/watch?v=WMDG_BL65kw

- Dental Material: https://formlabs.com/store/dental-lt-clear-resin-v2/

- Dental Anatomy of Dogs http://www.vivo.colostate.edu/hbooks/pathphys/digestion/pregastric/dogpage.html

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